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1 [A Computing Procedure for Quantification Theory](#)

Martin Davis, Hilary Putnam

 July 1960 **Journal of the ACM (JACM)**, Volume 7 Issue 3

 Full text available: [pdf\(1.07 MB\)](#)

 Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The hope that mathematical methods employed in the investigation of formal logic would lead to purely computational methods for obtaining mathematical theorems goes back to Leibniz and has been revived by Peano around the turn of the century and by Hilbert's school in the 1920's. Hilbert, noting that all of classical mathematics could be formalized within quantification theory, declared that the problem of finding an algorithm for determining whether or not a given formula of quantification ...

2 [Knowledge compilation and theory approximation](#)

Bart Selman, Henry Kautz

 March 1996 **Journal of the ACM (JACM)**, Volume 43 Issue 2

 Full text available: [pdf\(2.36 MB\)](#)

 Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

Computational efficiency is a central concern in the design of knowledge representation systems. In order to obtain efficient systems, it has been suggested that one should limit the form of the statements in the knowledge base or use an incomplete inference mechanism. The former approach is often too restrictive for practical applications, whereas the latter leads to uncertainty about exactly what can and cannot be inferred from the knowledge base. We present a third alternative, in which ...

Keywords: Horn clauses, efficient reasoning methods, knowledge compilation, knowledge-base optimization, query evaluation, theory approximation

3 [Logic programming as constructivism: a formalization and its application to databases](#)

F. Bry

 March 1989 **Proceedings of the eighth ACM SIGACT-SIGMOD-SIGART symposium on Principles of database systems**

 Full text available: [pdf\(1.74 MB\)](#)

 Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The features of logic programming that seem unconventional from the viewpoint of classical logic can be explained in terms of constructivistic logic. We motivate and propose a constructivistic proof theory of non-Horn logic programming. Then, we apply this formalization for establishing results of practical interest. First, we show that 'stratification' can be motivated in a simple and intuitive way. Relying on similar motivations, we introduce the larger classes of 'loosely stratif ...

4

[Logic and logic programming](#)

J. A. Robinson

March 1992 **Communications of the ACM**, Volume 35 Issue 3

Full text available:  pdf(6.56 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: unification

5 [Automatic Theorem Proving with Built-in Theories Including Equality, Partial Ordering, and Sets](#)

James R. Slagle

January 1972 **Journal of the ACM (JACM)**, Volume 19 Issue 1

Full text available:  pdf(1.11 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

6 [An Assessment of Techniques for Proving Program Correctness](#)

Bernard Elspas, Karl N. Levitt, Richard J. Waldinger, Abraham Waksman


June 1972 **ACM Computing Surveys (CSUR)**, Volume 4 Issue 2

Full text available:  pdf(4.36 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

7 [Z-module reasoning: an equality-oriented proving method with built-in ring axioms](#)

Tie-Cheng Wang

July 1993 **Journal of the ACM (JACM)**, Volume 40 Issue 3

Full text available:  pdf(3.29 MB) Additional Information: [full citation](#), [references](#), [index terms](#), [review](#)

Keywords: Gaussian elimination, equality reasoning, linearization, paramodulation, ring theory

8 [A Unifying View of Some Linear Herbrand Procedures](#)

D. W. Loveland


April 1972 **Journal of the ACM (JACM)**, Volume 19 Issue 2

Full text available:  pdf(1.07 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

9 [The complexity of theorem-proving procedures](#)

Stephen A. Cook

May 1971 **Proceedings of the third annual ACM symposium on Theory of computing**


Full text available:  pdf(481.03 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

It is shown that any recognition problem solved by a polynomial time-bounded nondeterministic Turing machine can be "reduced" to the problem of determining whether a given propositional formula is a tautology. Here "reduced" means, roughly speaking, that the first problem can be solved deterministically in polynomial time provided an oracle is available for solving the second. From this notion of reducible, polynomial degrees of difficulty are defined, and it is shown ...

10 [Theorem proving in propositional logic on vector computers using a generalized Davis-Putnam procedure](#)

Wen-Tsuen Chen, Ming-Yi Fang

November 1990 **Proceedings of the 1990 ACM/IEEE conference on Supercomputing**

Full text available:  pdf(948.27 KB) Additional Information: [full citation](#), [abstract](#), [references](#)

The Davis - Putnam procedure (DPP) is an efficient and well-known method for solving the theorem proving

problem in propositional logic. In this paper, we present an effective technique for vectorizing the DPP. To speed up the execution of DPP, the rules used by the procedure is first generalized by considering more than one literal at a time. Then vectorized algorithms based on the generalized rules are proposed. Experiments are conducted on vector computers. The results show the vectorized ver ...

11 On sufficient conditions for unsatisfiability of random formulas

Albert Atserias

March 2004 **Journal of the ACM (JACM)**, Volume 51 Issue 2

Full text available:  [pdf\(214.30 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)


A descriptive complexity approach to random 3-SAT is initiated. We show that unsatisfiability of any significant fraction of random 3-CNF formulas cannot be certified by any property that is expressible in Datalog. Combined with the known relationship between the complexity of constraint satisfaction problems and expressibility in Datalog, our result implies that any constraint propagation algorithm working with small constraints will fail to certify unsatisfiability almost always. Our result is ...

Keywords: Random CNF formulas, datalog, pebble games, phase transitions, propositional resolution, satisfiability

12 Advances in SAT: SAT-based unbounded symbolic model checking

Hyeong-Ju Kang, In-Cheol Park

June 2003 **Proceedings of the 40th conference on Design automation**

Full text available:  [pdf\(191.25 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


This paper describes a SAT-based unbounded symbolic model checking algorithm. BDDs have been widely used for symbolic model checking, but the approach suffers from memory overflow. The SAT procedure was exploited to overcome the problem, but it verified only the states reachable through a bounded number of transitions. The proposed algorithm deals with unbounded symbolic model checking. The conjunctive normal form is used to represent sets of states and the transition relation, and a SAT procedu ...

Keywords: boolean satisfiability checking, formal verification, symbolic model checking, unbounded symbolic model checking

13 The complexity of satisfiability problems

Thomas J. Schaefer

May 1978 **Proceedings of the tenth annual ACM symposium on Theory of computing**


Full text available:  [pdf\(1.10 MB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

The problem of deciding whether a given propositional formula in conjunctive normal form is satisfiable has been widely studied. It is known that, when restricted to formulas having only two literals per clause, this problem has an efficient (polynomial-time) solution. But the same problem on formulas having three literals per clause is NP-complete, and hence probably does not have any efficient solution. In this paper, we consider an infinite class of satisfiability problems wh ...

14 Algorithms for quantified Boolean formulas

Ryan Williams

January 2002 **Proceedings of the thirteenth annual ACM-SIAM symposium on Discrete algorithms**

Full text available:  [pdf\(844.89 KB\)](#) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#)

We present algorithms for solving quantified Boolean formulas (QBF, or sometimes QSAT) with worst case runtime asymptotically less than $O(2^n)$ when the clause-to-variable ratio is smaller or larger than some constant. We solve QBFs in conjunctive normal form (CNF) in $O(1.709^m)$ time and space, where m is the number of clauses. Extending the technique to a quantified version of constraint satisfaction problems (QCSP), we solve QCSP with domai ...

15 Dissolution: making paths vanish

Neil V. Murray, Erik Rosenthal

July 1993 **Journal of the ACM (JACM)**, Volume 40 Issue 3


Full text available:  pdf(1.98 MB) Additional Information: [full citation](#), [references](#), [citations](#), [index terms](#)

Keywords: Prawitz analysis, automated deduction, inference, matrix methods

16 [Inference with path resolution and semantic graphs](#)

Neil V. Murray, Erik Rosenthal

April 1987 **Journal of the ACM (JACM)**, Volume 34 Issue 2


Full text available:  pdf(2.31 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#), [review](#)

A graphical representation of quantifier-free predicate calculus formulas in negation normal form and a new rule of inference that employs this representation are introduced. The new rule, path resolution, is an amalgamation of resolution and Prawitz analysis. The goal in the design of path resolution is to retain some of the advantages of both Prawitz analysis and resolution methods, and yet to avoid to some extent their disadvantages. Path resolution allows Pra ...

17 [Equality-based binary resolution](#)

Vincent J. Digricoli, Malcolm C. Harrison

April 1986 **Journal of the ACM (JACM)**, Volume 33 Issue 2

Full text available:  pdf(2.31 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

A major event in automated reasoning was the introduction by Robinson of resolution as an inference principle that is complete for the first-order predicate calculus. Here the theory of binary resolution, based strictly on unification, is recast to incorporate the axioms of equality. Equality-based binary resolution is complete without making use of paramodulation and leads to refutations that are less than half as long as standard refutations with the equality axioms. A detailed discussion ...

18 [Mini-buckets: A general scheme for bounded inference](#)

Rina Dechter, Irina Rish

March 2003 **Journal of the ACM (JACM)**, Volume 50 Issue 2

Full text available:  pdf(902.27 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)


This article presents a class of approximation algorithms that extend the idea of bounded-complexity inference, inspired by successful constraint propagation algorithms, to probabilistic inference and combinatorial optimization. The idea is to bound the dimensionality of dependencies created by inference algorithms. This yields a parameterized scheme, called *mini-buckets*, that offers adjustable trade-off between accuracy and efficiency. The mini-bucket approach to optimization problems, s ...

Keywords: Accuracy/complexity trade-off, Bayesian networks, approximation algorithms, combinatorial optimization, probabilistic inference.

19 [On the lengths of proofs in the propositional calculus \(Preliminary Version\)](#)

Stephen Cook, Robert Reckhow

April 1974 **Proceedings of the sixth annual ACM symposium on Theory of computing**


Full text available:  pdf(1.01 MB) Additional Information: [full citation](#), [abstract](#), [references](#), [citations](#), [index terms](#)

One of the most important open questions in the field of computational complexity is the question of whether there is a polynomial time decision procedure for the classical propositional calculus. The purpose of the present paper is to study a question related to the complexity of decision procedures for the propositional calculus; namely, the complexity of proof systems for the propositional calculus. The fundamental issue here is whether there exists any proof system, and a pol ...

20 Properties of Programs and the First-Order Predicate Calculus

Zohar Manna

April 1969 **Journal of the ACM (JACM)**, Volume 16 Issue 2

Full text available:  pdf(662.42 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [citings](#), [index terms](#)

This paper is concerned with the relationship of the termination problem for programs and abstract programs to the validity of certain formulas in the first-order predicate calculus. By exploiting this relationship, subclasses of abstract programs for which the termination problem is decidable can be isolated. Moreover, known proof procedures for the first-order predicate calculus (e.g. resolution) can be applied to prove the termination of both programs and abstract programs. The correctne ...

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1 [Alternating-time temporal logic](#)

Rajeev Alur, Thomas A. Henzinger, Orna Kupferman

September 2002 **Journal of the ACM (JACM)**, Volume 49 Issue 5

Full text available: pdf(345.26 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Temporal logic comes in two varieties: *linear-time temporal logic* assumes implicit universal quantification over all paths that are generated by the execution of a system; *branching-time temporal logic* allows explicit existential and universal quantification over all paths. We introduce a third, more general variety of temporal logic: *alternating-time temporal logic* offers selective quantification over those paths that are possible outcomes of games, such as the game in which ...

Keywords: Alternation, games, model checking, temporal logic

2 [Convergent approximate solving of first-order constraints by approximate quantifiers](#)

Stefan Ratschan

April 2004 **ACM Transactions on Computational Logic (TOCL)**, Volume 5 Issue 2

Full text available: pdf(123.02 KB) Additional Information: [full citation](#), [abstract](#), [references](#), [index terms](#)

Exactly solving first-order constraints (i.e., first-order formulas over a certain predefined structure) can be a very hard, or even undecidable problem. In continuous structures like the real numbers it is promising to compute approximate solutions instead of exact ones. However, the quantifiers of the first-order predicate language are an obstacle to allowing approximations to arbitrary small error bounds. In this article, we remove this obstacle by modifying the first-order language and repla ...

Keywords: Decision procedures, constraints, generalized quantifiers, real numbers

3 [Special issue on knowledge representation](#)

Ronald J. Brachman, Brian C. Smith

February 1980 **ACM SIGART Bulletin**, Issue 70

Full text available: pdf(13.13 MB) Additional Information: [full citation](#), [abstract](#)

In the fall of 1978 we decided to produce a special issue of the SIGART Newsletter devoted to a survey of current knowledge representation research. We felt that there were two useful functions such an issue could serve. First, we hoped to elicit a clear picture of how people working in this subdiscipline understand knowledge representation research, to illuminate the issues on which current research is focused, and to catalogue what approaches and techniques are currently being developed. Secon ...

4 [Simplify: a theorem prover for program checking](#)

David Dettlefs, Greg Nelson, James B. Saxe


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IEE JNL	IEE Journal or Magazine
IEEE CNF	IEEE Conference Proceeding
IEE CNF	IEE Conference Proceeding
IEEE STD	IEEE Standard


1. Hierarchical constraint solving in the parametric form with an efficient symbolic simulation based verification

 Jain, P.; Gopalakrishnan, G.;
 Computer Design: VLSI in Computers and Processors, 1993. ICC Proceedings., 1993 IEEE International Conference on
 3-6 Oct. 1993 Page(s):304 - 307
 Digital Object Identifier 10.1109/ICCD.1993.393361

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IEEE JNL IEE Journal or Magazine

IEEE CNF IEEE Conference Proceeding

IEEE CNF IEEE Conference Proceeding

IEEE STD IEEE Standard

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Duraïra, V.; Kalla, P.;
High-Level Design Validation and Test Workshop, 2004. Ninth IEEE International
10-12 Nov. 2004 Page(s):141 - 146
Digital Object Identifier 10.1109/HLDVT.2004.1431257
[AbstractPlus](#) | Full Text: [PDF](#)(2081 KB) IEEE CNF
- ☐ 2. **Resynthesis of multi-level circuits under tight constraints using optimization**
Kravets, V.N.; Sakallah, K.A.;
Computer Aided Design, 2002. ICCAD 2002. IEEE/ACM International Conference on
10-14 Nov. 2002 Page(s):687 - 693
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- ☐ 3. **Optimum and heuristic algorithms for an approach to finite state decomposition**
Ashar, P.; Devadas, S.; Newton, A.R.;
Computer-Aided Design of Integrated Circuits and Systems, IEEE Transactions on
Volume 10, Issue 3, March 1991 Page(s):296 - 310
Digital Object Identifier 10.1109/43.67784
[AbstractPlus](#) | Full Text: [PDF](#)(1468 KB) IEEE JNL
- ☐ 4. **Efficient decomposition of assigned sequential machines and functions for PLD implementations**
Jozwiak, L.; Wolf, F.;
Electronic Technology Directions to the Year 2000, 1995. Proceedings
23-25 May 1995 Page(s):258 - 266
Digital Object Identifier 10.1109/ETD.1995.403465
[AbstractPlus](#) | Full Text: [PDF](#)(616 KB) IEEE CNF
- ☐ 5. **Boolean decomposition in multi-level logic optimization**
Devadas, S.; Wang, A.R.; Newton, A.R.; Sangiovanni-Vincentelli, S.;
Computer-Aided Design, 1988. ICCAD-88. Digest of Technical Papers

International Conference on
7-10 Nov. 1988 Page(s):290 - 293
Digital Object Identifier 10.1109/ICCAD.1988.122513
[AbstractPlus](#) | Full Text: [PDF](#)(388 KB) IEEE CNF

- ☐ **6. An efficient method for decomposition of multiple-output Boolean functions and assigned sequential machines**
Jozwiak, L.; Volf, F.;
Design Automation, 1992. Proceedings. [3rd] European Conference
16-19 March 1992 Page(s):114 - 122
Digital Object Identifier 10.1109/EDAC.1992.205905
[AbstractPlus](#) | Full Text: [PDF](#)(624 KB) IEEE CNF

- ☐ **7. Boolean decomposition of programmable logic arrays**
Devadas, S.; Wang, A.R.; Newton, A.R.; Saniovanni-Vincentelli, /
Custom Integrated Circuits Conference, 1988., Proceedings of the
16-19 May 1988 Page(s):2.5/1 - 2.5/5
Digital Object Identifier 10.1109/CICC.1988.20787
[AbstractPlus](#) | Full Text: [PDF](#)(488 KB) IEEE CNF

- ☐ **8. Power efficient technology decomposition and mapping and extended power consumption model**
Chi-Ying Tsui; Pedram, M.; Despain, A.M.;
Computer-Aided Design of Integrated Circuits and Systems, IEEE
on
Volume 13, Issue 9, Sept. 1994 Page(s):1110 - 1122
Digital Object Identifier 10.1109/43.310900
[AbstractPlus](#) | Full Text: [PDF](#)(1128 KB) IEEE JNL

- ☐ **9. Solution of multivalued logic algebra equations**
Tapia, M.A.;
Southeastcon '89. Proceedings. 'Energy and Information Technology
Southeast', IEEE
9-12 April 1989 Page(s):245 - 250 vol.1
Digital Object Identifier 10.1109/SECON.1989.132368
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Bouchard, S.; Diou, A.;
Industrial Electronics, 1998. Proceedings. ISIE '98. IEEE International
Symposium on
Volume 2, 7-10 July 1998 Page(s):487 - 492 vol.2
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